

## CLAIMS

What is claimed is:

- 1           1.    An eye-safe laser comprising:  
2           a laser for coupling to a source of pump energy to  
3   generate laser energy; and  
4           a wavelength shifting crystal coupled to the laser  
5   for generating eye-safe light from the laser energy.
- 1           2.    The eye-safe laser of Claim 1 wherein the  
2   laser energy has a wavelength of about 1.3 microns.
- 1           3.    The eye-safe laser of Claim 1 wherein the  
2   eye-safe light has a wavelength of about 1.5 microns.
- 1           4.    The eye-safe laser of Claim 1 further  
2   comprising the source of pump energy.
- 1           5.    The eye-safe laser of Claim 4 wherein the  
2   source of pump energy comprises a laser diode or a laser  
3   diode array.
- 1           6.    The eye-safe laser of Claim 1 wherein the  
2   wavelength shifting crystal comprises a Raman shifting  
3   crystal.
- 4           7.    The eye-safe laser of Claim 6 wherein the  
5   Raman shifting crystal comprises  $\text{BaNO}_3$  or  $\text{KGd}(\text{WO}_4)_2$ .
- 1           8.    The eye-safe laser of Claim 1 further  
2   comprising a reflective coating on an inside end face of  
3   the wavelength shifting crystal that is highly  
4   transmissive of the laser energy and is highly reflective  
5   of the eye-safe light.

1           9. The eye-safe laser of Claim 1 further  
2 comprising a reflective coating on an outside end face of  
3 the wavelength shifting crystal that is highly reflective  
4 of the laser energy and is highly transmissive of the  
5 eye-safe light.

1           10. The eye-safe laser of Claim 1 wherein the  
2 laser comprises:  
3       an input coupler for coupling to a source of pump  
4 energy;  
5       a laser gain element coupled to the input coupler  
6 for generating laser energy from the pump energy; and  
7       an output coupler coupled to the laser gain element.

1           11. The eye-safe laser of Claim 10 wherein the  
2 input coupler, the laser gain element, the output  
3 coupler, and the wavelength shifting crystal are joined  
4 by at least one of diffusion bonding, gluing, and optical  
5 contacting by mechanical means.

1           12. The eye-safe laser of Claim 10 further  
2 comprising a passive Q-switch coupled to the laser gain  
3 element for increasing peak power output.

1           13. The eye-safe laser of Claim 12 wherein the  
2 input coupler, the laser gain element, the passive Q-  
3 switch, the output coupler, and the Wavelength shifting  
4 crystal are joined by at least one of diffusion bonding,  
5 gluing, and optical contacting by mechanical means.

1           14. The eye-safe laser of Claim 12 wherein the  
2 passive Q-switch comprises a passive Q-switch material.

1           15. The eye-safe laser of Claim 13 wherein the  
2 passive Q-switch material is  $V^{3+}$ :YAG or  $Nd^{2+}$ : $SrF_2$ .

1           16. The eye-safe laser of Claim 12 wherein the  
2 output coupler comprises a reflective coating between the  
3 Q-switch and the wavelength shifting crystal that is  
4 partially reflective of the laser energy and is highly  
5 reflective of the pump energy.

1           17. The eye-safe laser of Claim 10 further  
2 comprising a focusing lens coupled to the laser diode for  
3 focusing pump energy on the laser gain element.

1           18. The eye-safe laser of Claim 10 wherein the  
2 input coupler comprises a reflective coating on an end  
3 face of the laser gain element between the laser gain  
4 element and the pump energy source that is highly  
5 transmissive of the pump energy and highly reflective of  
6 the laser energy.

1           19. The eye-safe laser of Claim 10 wherein the  
2 output coupler comprises a reflective coating between the  
3 laser gain element and the Wavelength shifting crystal  
4 that is partially reflective of the laser energy and  
5 highly reflective of the pump energy.

1           20. The eye-safe laser of Claim 10 wherein the  
2 laser gain element comprises an  $\text{Nd}^{3+}:\text{YAlO}_3$  crystal having  
3 a laser wavelength of about 1.3 microns.

1           21. An eye-safe laser comprising:  
2 means for generating laser energy; and  
3 means for transforming the laser energy into eye-  
4 safe light.

1           22. The eye-safe laser of Claim 21 wherein the  
2 laser energy has a wavelength of about 1.3 microns.

1           23. The eye-safe laser of Claim 21 wherein the

2 eye-safe light has a wavelength of about 1.5 microns.

1           24. The eye-safe laser of Claim 21 wherein the  
2 means for generating laser energy comprises:

3           an input coupler for receiving pump energy;  
4           a laser gain element coupled to the input coupler  
5 for generating laser energy from the pump energy; and  
6           an output coupler coupled to the laser gain element.

1           25. The eye-safe laser of Claim 24 further  
2 comprising means for generating the pump energy.

1           26. The eye-safe laser of Claim 25 wherein the  
2 means for generating the pump energy comprises a laser  
3 diode or a laser diode array.

1           27. The eye-safe laser of Claim 24 wherein the  
2 input coupler, the laser gain element, the output  
3 coupler, and the means for transforming the laser energy  
4 into eye-safe light are joined by at least one of  
5 diffusion bonding, gluing, and optical contacting by  
6 mechanical means.

1           28. The eye-safe laser of Claim 24 further  
2 comprising means for increasing peak power output of the  
3 laser gain element.

1           29. The eye-safe laser of Claim 28 wherein the  
2 means for increasing peak power output comprises a  
3 passive Q-switch material.

1           30. The eye-safe laser of Claim 29 wherein the  
2 passive Q-switch material is  $V^{3+}$ :YAG or  $Nd^{2+}$ :SrF<sub>2</sub>.

1                   31. The eye-safe laser of Claim 24 further  
2 comprising means for focusing the pump energy on the  
3 laser gain element.

1                   32. The eye-safe laser of Claim 24 wherein the  
2 laser gain element comprises an  $\text{Nd}^{3+}:\text{YAlO}_3$  crystal having  
3 a laser wavelength of about 1.3 microns.

1                   33. The eye-safe laser of Claim 21 wherein the  
2 means for transforming comprises  $\text{BaNO}_3$  or  $\text{KGd}(\text{WO}_4)_2$ .